ASSAWOMAN WILDLIFE AREA

MANAGEMENT PLAN

WRITTEN BY

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ON

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(PARTIAL REVISION)

Note: This plan is posted as a draft revision of the original plan written in 1986. The original plan was unavailable in a suitable format for posting on the web site. This version of the management plan represents my attempt in 1986 to revise the plan. The revision is incomplete. Please read this plan with that fact in mind.

I. INTRODUCTION

Since I wrote the first wildlife management plan for the Assawoman Wildlife Area in 1986, I have gained a better appreciation for its uniqueness. The wetland communities, the rare plants, the abundant birdlife, the tree frogs singing each spring, the inland bays, the summer crowds, all contribute to my feeling of wonder and rekindle my commitment to its stewardship.

Everyone who regularly visits here, comes for their own reasons; crabbing, birding, hunting, picnics, or a quiet place to drive on a nice morning. Those who appreciate its uniqueness, each have their own ideas on its care. I have learned to share their excitement and fascination. I have also learned how competing interests can " love the place to death ".

This plan is written to enlighten and enhance their awareness while encouraging responsible use of the resources. I will continue to manage the wildlife area for the conservation of all its natural resources while providing compatible recreational opportunities. I will strive to instill a sense of stewardship to all its users. I will also help the users learn how to share this unique place with all its friends.

I look back on the original management plan and realize it was overly ambitious and detailed. I was still learning about the area and had yet to try many of the "techniques" I had dreamed up. Some plans worked, others sputtered. I have learned from my mistakes. This plan will build on the successes and failures of the past five years and hopefully anticipate its needs better for the next ten year period (1995 - 2005).

Rather than rewriting the entire plan, I will use a narrative style to highlight substantial changes within the existing sections of the original plan. Sections without substantive change will not be discussed, e.g., area description, needs of the human population, wildlife surveys and inventories. Maps will be upgraded, accomplishments highlighted, and plans outlined and discussed.

II. PURPOSE OF PLAN

The purpose of this plan is to develop a record of long and short term goals which integrates the management of renewable natural resources on the Assawoman Wildlife Area. Delaware's Inland Bays region will be developed at an increasing rate in the next decade. As water, air, and habitat quality diminish, the need for a regional land use plan will become more apparent. Assawoman Wildlife Area is the only public land on the Little Assawoman Bay expressly managed for wildlife. Its future and ability to sustain the increased demand for outdoor recreation will depend on a written plan designed to anticipate the conflicts of human and animal use of habitat.

III. GENERAL MANAGEMENT OBJECTIVES AND GOALS

Although these objectives and goals have not changed, I want to reiterate them for emphasis. In light of the current controversy over northern bobwhite management within Delaware, please note that my original goal of placing greater emphasis on upland management has not only been actively pursued throughout the past five years, but will continue to be an important directive in shaping my management objectives for the next five years.

1. Greater emphasis on the management of upland animals.
2. Improve knowledge and techniques for better impoundment management.
3. Create a better balance of habitat types.
4. Establish an improved inventory system for plants and animals.
5. Improve the hunting program.
6. Plan for a shift of "user" needs.
7. Update and improve the methods of surveying the people who use the area.

IV. DESCRIPTION OF AREA

A. General.

Assawoman Wildlife Area is located in the southeast corner of Delaware on the Little Assawoman Bay. A peninsula called Millers Neck lays between Millers Creek on the north and Dirickson's Creek on the south and forms the backbone of the area.

The Wildlife Area is comprised of three disjunct, but contiguous parcels of land - Miller Neck (335.5 acres), Muddy Neck (284.1 acres), and the Beach (75.8 acres). The total acreage for the Assawoman Wildlife Area as of June 1989 to present is 1695.4 acres. This total reflects the addition of the Hickman Tract purchased in June 1989. The 227 acre farm has 104.1 acres of woods (mostly loblolly pine with some oak in the higher spots), 83.74 acres of tidal marsh, and 38.95 acres of farmed fields (mostly wet soils).

The property was bought with Land and Water Conservation Funds to protect a rare plant site and Delmarva Fox Squirrel habitat. The addition of the Hickman Tract expanded the wildlife area towards the southwest. The property stretches from Dirickson Creek to the uplands to include a Delmarva Bay containing Hirst's' panic grass (Panicum hirstii) and awned meadow beauty (Rhexia aristosa) - two candidates for listing as endangered plant species by the U. S. Fish and Wildlife Service.

A portion of the barrier island between Little Assawoman Bay and the Atlantic Ocean belongs to the Delaware Division of Fish and Wildlife. This seventy six acre tract of back dune and marsh constitutes the remainder of the area. Although still on the our property list and managed in

accordance with the goals and objectives of this plan, the daily management of this tract was assumed by the Division of Parks and Recreation as part of the Fenwick Island State Park. A copy of the agreement is listed in the appendix (Appendix 1).

B. Past Conditions.

The pavilions at Strawberry and Mulberry Landings were built during the Great Depression by local people working under the Public Works Administration, part of President Roosevelt's New Deal program, not for the WLA as reported in the original plan.

C. Cultural History.

A recent survey for archaeological sites within the wildlife area (Clark and Scholl 1994) located sixteen prehistoric sites, two historic (CCC) buildings, and one historic component of a prehistoric site. In addition, twelve potential historic sites were identified through documentary research. A settlement pattern of low intensity exploitation of the Assawoman Wildlife Area was found. The Indian River and Rehoboth Rivers were exploited more heavily. A series of small, undisturbed procurement sites with limited activities were identified in wooded areas along the bay.

D. Flood, fire, and other calamity history.

Several hurricanes have threatened the wildlife area over the past nine years. None have caused substantial damage other than downed trees and flooding. Each storm has brought saltwater into the impoundments and caused some overtopping of the dikes.

V. Wildlife Population Status.

A. Waterfowl

Waterfowl use of the Area is well documented. Wintering and migrating waterfowl are counted during monthly aerial surveys performed October through January each year (since mid-50's). Waterfowl hunters are required to report waterfowl harvested on the state owned blinds (since 1975). Spring migrants and nesting pairs are presently not counted and their status is unclear. Brood surveys were performed until the numbers of nesting pairs declined, then resumed in 1986 on an informal basis.

Aerial survey records show that winter waterfowl use is variable, but has remained high (Appendix Tables 3-6). Canada Goose (Branta canadensis) numbers are still depressed and a shortened season with a reduced bag limit continues (a 30 day season with 1 bird per day). Significant numbers of snow geese (Chen caerulescens) est. (3 - 6,000 birds) use the refuge ponds as roosting sites. Mute swans (Cygnus olor) have started to congregate in late summer and early

fall. Two pairs attempted to nest in 65 Acre Pond in 1993 & 1994. Ruddy Ducks (Oxyura jamaicensis) have stopped using the Goose Pond in the winter, starting in 1990. Appendix Tables 7 - 9 list the annual waterfowl harvest as reported by hunters using the Wildlife Area since 1975.

B. White-tailed Deer

The White-tailed Deer (Odocoileus virginianus) herd on the Area is higher than desirable, although serious habitat degradation has not been documented. In 1993, 27 deer were harvested (Table), the highest harvest to date. A five year average for the years 1989 - 1993 was 15.4 deer per year. Total kill (harvest plus animals lost but thought to be dead) averaged 19.6 for the same 5 year period (Table). Harvest had remained stable for the four year period preceding (1989 - 1992) averaging 13 animals per year, then jumped in 1993 when 25 deer were harvested. At least some of the reason the harvest nearly doubled in 1993 is the handicapped deer hunter harvest. Six deer were taken from the refuge by handicapped hunters, and they pushed alot of deer out of the refuge during their hunts.

Spotlight counts were attempted in 1990 - 1992 to assess the density of the herd. After several counts it was apparent that the lack of big open fields precluded the effectiveness of this technique at Assawoman. However, I believe that the deer herd is expanding. Sunflower planted for dove hunting is eaten by deer before harvest. Milo, corn, and soybeans are eaten long before the winter.

Several older adult bucks were taken in the past few years. A 9 pt. 4 1/2 year old buck was killed by a handicapped hunter in 1993. A 2 1/2 year old buck (8 pt.) was taken in 1994. A 2 1/2 year old doe (84 lbs.) was killed in 1993. However, the bulk of the harvest is yearling bucks and fawns of both sexes.

D. Upland Game

1. Northern Bobwhite

Unfortunately the harvest data does not provide a clear picture of the quail's status on the wildlife area. Based on harvest records from 1987 - 1993, an average of 68 hunters spend 142 hours each year to shot 40 and bag 33 birds (Table). The best year for quail harvest was 1990 when 79 birds were shot, however, the next best years were 1988 and 1989 when 41 birds were shot each year - a 52 % difference from highest to next highest. In 1992 only 29 birds were shot. In a year with the least number of hunter hours (82 hours), the highest hunter success ratio occurred (1993). Still the harvest was only 37 birds. The question that remains unanswered is which density independent factor has the most influence on yearly population variation - the vagaries of weather, habitat conditions, natural mortality, or hunting mortality.

Preliminary pre-season covey counts were initiated in 1990 on Assawoman & Nanticoke and in 1994 on Assawoman. A covey count in October, 1994 produced 3 coveys (approximately 45 birds) each count.

Summer call counts were initiated again in June 1995. The route covered only the wildlife area and constituted a complete count. On three successive counts a total of 42 singing males were heard. The average call count total was 14 birds heard per route. Calls increased in frequency from mid-June to mid-July.

2. Eastern Cottontail

Eastern Cottontails are present, but not abundant. The distribution seems to be limited to clumps of heavy Greenbriar and upland woods bordered by lightly stocked Phragmites stands. Hunting is light and non-specific, so hunting records do not offer a clear picture of abundance. No more than 9 rabbits were shot in any one year, and the average harvest for seven years is 5 rabbits per year (Table).

3. Gray Squirrel

The Area was closed to all squirrel hunting in 1984 when Delmarva Fox Squirrels (Sciurus cinereus nigra) were introduced. Therefore no harvest records exist. Gray squirrels were found in squirrel nest boxes 36% of the time from 1986 - 1990.

E. Furbearers

1. Raccoon

Based on the current rabies epidemic, I feel that the raccoon population is depressed. No empirical data available.

2. Opossum

No change since the 1988 plan assessment.

3. Muskrat (Ondatra zibethicus)

Muskrat numbers seem to be rebounding due largely to a more stable water level in Mulberry and 65 Acre Ponds. I have continued to drawdown the ponds, which negatively impacts muskrats, but good bulrush, feathergrass, and cattail has created better food sources. The new wells provide a reliable source of water and a more predictable water regime.

4. River Otter (Lutra canadensis)

River otter are present in the creeks and ponds around Assawoman. Otter "toilets" occur on every dike on the area. Otter runways are present between the brackish creeks and all the impoundments. I believe otter densities have increased the past eight years.

5. Gray and Red Fox

Both Gray and Red Foxes (Vulpes fulva) are present on the Area. Fox "hunters" chase both species and report that they are present. I believe foxes densities are stable, or increasing.

6. Eastern Striped Skunk

Since the first plan, I have smelled skunk odor on two occasions. However, I have yet to see a skunk. I believe they are present, but in low numbers.

F. Songbirds

The presence and breeding status of endemic songbirds is documented in the Breeding Bird Atlas of Delaware originally slated for publication in the spring of 1989, but now may be published in 1995. The Division has contributed data for the Assawoman Wildlife. A Christmas Bird Count has been done at Assawoman every year since I arrived (1985). These records are stored in the office files. No analysis of trends has been performed, but my general impression is that many species are less abundant than eight years ago.

G. Reptiles and Amphibians

Since 1988 I have heard New Jersey chorus frogs (Pseudacris triseratium feriarum), Eastern spadefoot toads (Scaphiopus h. holbrooki), wood frogs (Rana sylvatica), and identified a marbled salamander (Ambystoma opacum).

A young northern cooperhead (Agkistrodon contortrix maksen) was found on Muddy Neck in 1993. No other snake or lizard species have been found.

There are potentially other amphibians and reptiles that (and probably do) inhabit the Area. Their presence or absence will be recorded in a Wildlife Species Checklist as they are found. (see Appendix for a complete listing).

H. Endangered Species

1. Delmarva Fox Squirrel

The Delmarva Fox Squirrel was transplanted from Dorchester County Maryland in 1984. Six adults were released in the fall of 1984 and another seven in the spring of 1985. Trapping efforts failed until the spring of 1987, when 7 squirrels were trapped. Three juveniles were trapped. They were toe-clipped and subsequently released. Sightings of the squirrels are limited by their secrecy and our lack of manpower.

Delmarva fox squirrels are monitored by checking nest boxes at night during the winter months. Adult females with young have been found each year since we initiated the checks in 1991 (Table). However, fewer squirrels are being found, and there is a chance the squirrels are not doing as well as hoped. Another release has been discussed, but availability of squirrels has been a problem.

2. Piping Plover

Piping plovers (Charadrius melodus) have restricted their activities to the beach on the Atlantic Ocean. No birds have been sighted on Assawoman Wildlife Area.

3. Bald Eagle

No Bald Eagles nested on Assawoman until this year (1995). We saw birds along the creeks and impoundments with increasing regularity, but never during the breeding season.
A bald eagle nest was found along Miller's Creek between Sassafras Landing and Camp Barnes. The nest contained two 6 1/2 week old eaglets when checked in early June. This could be the second year for this nest, although no proof exists. Prey remains (terrapin shells) and feathers were found beneath the nest (1/10/95). Nesting could have started as early as February 1995.

4. Peregrine Falcon

Peregrine falcons are migrants along the coast, and have not been seen on the wildlife area.

5. Brown Pelican

Brown pelicans are being seen much more regularly in the past five years. Still no known breeding spot in Delaware.

I. Raptors

1. Osprey

Ospreys continue to proliferate along the coastal marshes of Delaware. They nest on the duck blinds in the Little Assawoman Bay every year. Reproductive data is available from the Nongame and Endangered Species Coordinator.

2. Hawks

No change since first plan.

3. Owls

No change since the first plan.

VI. USER TRENDS AND NEEDS.

A. Users

Waterfowl and deer hunters are the most plentiful hunter groups using Assawoman. Assawoman provided 697 hunter days of waterfowl hunting in 1986-87, the first year of the plan. Hunters hunted less during the drought years of 1986 - 1988 (462 - 542 hunters/year). Between 1990 - 1993, waterfowl hunter use rebounded to former levels and remained relatively constant (625 - 729). Nonresidents continue to represent 5 % of the hunter population.

Deer hunter use for all seasons remains high. The expansion of deer stands to 40 has helped alleviate any problems with overcrowding. However, the addition of more stands does not appear to have increased demand. The high use days are the first two days of the November shotgun season, and the October muzzleloader season.

Dove hunting has become more popular with the intensive dove field management program initiated in 1986. I began running a check station on weekends in September 1990 (?) when hunting permits were first required to obtain harvest data. As many as 75 hunters have hunted the dove fields during opening day.

Small game hunting pressure continues to be light. More intensive quail management has gone largely unnoticed by the hunters.

Assawoman continues to draw heavily from the non-hunting publics. The fishing areas receive heavy use during all the warm months of the year. No survey has been conducted to determine their numbers or their needs.

Boy Scout troops are using the area for camping at a slightly higher pace than the previous five years. They are limited by the insects in the warm months and hunting activities during the fall and winter.

Horseback riding clubs continue to use the area during the spring and fall. A local club runs tours on horse drawn carriages and buggies each fall. They like the easy access from Camp Barnes and the dirt road on the area for the tours.

Boat use of Mulberry Landing has increased since the major improvement of the pier and ramp in 1991. I think this trend will increase. Pavilion use has increased into the spring and fall months. The Division has provided portable toilets at the fishing areas since 1989 and plans to expand the length of time they are available into the fall and winter (starting in 1995).

B. Management directives based on user needs and desires.

A pavilion reservation system and user fee may be needed to accommodate the increasing use of the fishing areas. Trap Pond State Park has a reservation system and fee structure devised which might be worth reviewing.

An interpretative tour was developed in 1993 to educate the casual users on Assawoman's purpose and uniqueness. A brochure explaining the natural features, wildlife management goals and techniques, and the area's history is available at the entrance to the wildlife area. The tour has 13 stops with corresponding numbered posts distributed along the main roads on the area. Initial responses have been good.

An observation blind was installed near Mulberry Landing in 1989 which affords a close-up to resting waterbirds for photographers. Although the idea seemed like a good one, the blind rarely gets used.

A user fee may still be justified given the extent of use by unlicensed, nontraditional visitors. Fees paid for hunting, fishing, and boat registration could be credited towards the cost of an entrance fee. If the Wildlife Diversity Funding Initiative passes, funding for an expansion of viewing opportunities will sought out.

More information on the nontraditional users needs to be collected. A weekend survey done during the spring, summer, and fall months would give us a better idea of who these people are, how many there are, where they travel from, what brings them here, and what they need.

VII. Coordinating Measures and Broad Management Objectives.

The Division's mission is worth repeating in this revision, especially knowing that the area has a multitude of rare plants. The protection of a new bald eagle nest on Assawoman prompts me to review the following guideline.

The Division's goal is perpetuating the natural diversity of indigenous plant and animal communities and restoring extirpated species when possible. We will encourage, manage, and support the wise use of our wildlife resources as long as their viability is not jeopardized. Our

approach will be to manage ecosystems, to maximize plant and animal diversity and thus increase ecosystem stability.

Our first responsibility is to the wildlife and their habitat. A species' viability must be secure before we fulfill our second responsibility - to manage our wildlife resources for recreation, economics, and scientific instruction. We are committed to the concept of multiple-use management provided the practice does not harm the resource or infringe upon the rights of others. Balancing user's needs while conserving the resource requires careful planning and the application of prudent management policies.

1. We are committed to managing ecosystems. We will recommend no action that threatens the viability of a native species or population.
2. We will manage wildlife species as viable, self-supporting, and free-ranging populations. Consideration will be given to all species to maintain diversity and stability and to maximize the variety of human experience.
3. Restoring native species which have become extirpated will be one of our goals provided that their reintroduction does not adversely affect man.
4. We will acquire land for wildlife habitat management purposes when that land is a manageable size, adjoins our property, but doesn't create inholdings, or provides habitat critical for a threatened species.
5. We will consider consumptive and nonconsumptive uses and oppose competitive use that are detrimental to wildlife populations or habitats.
6. Population and habitat manipulations are acceptable management tools provided the viability of a species is not threatened.
7. We recognize hunting, fishing, and trapping as legitimate management tools and as recreational pursuits. We will strive to meet the demands for hunting and trapping as long as species viability is not jeopardized.
8. We recognize that some competitive land uses are essential to human well-being; we will mitigate on uses beyond our control and educate competitive users of the trade-offs.

9. Fulfilling our goals requires public support. We will attempt to educate people to wildlife benefits and instill a sense of responsibility towards the resource.

Timber harvest will be used as a habitat manipulation tool and as a revenue source. Small timber sales (less than 15 acres) provide early successional stages of vegetation, promote herbaceous growth, create escape and nesting cover, and increase interspersion. Timber harvests will be planned with the premise that wildlife management objectives have priority over strict income generation.

Wildlife management is balancing the needs of both animals and people. The same principle applies on the Wildlife Areas. Recreation is permitted provided it does not interfere with some critical segment of an animal's life cycle. Nor will one person's recreational endeavors disrupt, interfere, or diminish the enjoyment of another's recreation.

Off road vehicles are incompatible with the objectives of this wildlife area and will not be permitted. The refuge is off limits to unauthorized vehicles, foot travel, or horseback riding. Refuges provide undisturbed nesting areas where human interference is minimized. Many of the

fishing areas are adjacent to the refuge. Picnicking is restricted to the fishing areas. The refuge will be open for legitimate wildlife management work, animal surveys, and educational tours provided prior written permission is granted from an authorized representative of the Division. Three sites are provided for handicapped deer hunters. Because this activity occurs within the refuge a permit is required.

VIII. Wildlife Management Practices.

A. Statement of Priority of Practices.

The Assawoman Wildlife Area is primarily managed for migrating and wintering waterfowl, white-tailed deer, Delmarva fox squirrels, and northern bobwhites. Small game (eastern cottontails and gray squirrels) has secondary priority. Increasing emphasis will be placed on recognition and protection of rare plant sites, amphibians and reptiles, rabbit and quail management. Rare plants and freshwater wetlands will be given special consideration. As a reintroduced and an endangered species, the Delmarva fox squirrel will continue to warrant primary priority.

Management decisions will be weighed towards waterfowl needs in the impoundments, although mosquito control, waterbird and shorebird needs will be integrated.

B. Waterfowl Management Plan.

1. Goal revisions since last plan.

Please refer to the original plan for a discussion of waterfowl life history and justification for habitat management. Eight years after writing the first plan, I realize now that waterfowl production is an unrealistic management goal. Most waterfowl habitat occurs within the impoundments, although the fringe marshes do provide some nesting, feeding, and brood habitat. Nesting, feeding, and brood habitat quality and quantity on the impoundments is poor. I believe the impoundments are capable of supporting no more than a half dozen pairs of mallards and black ducks, and perhaps, a few pairs of nesting Canada geese.

Several factors limit waterfowl production including lack of water during sustained drawdowns designed to grow food for migrant and wintering waterfowl, lack of vegetational diversity limits brood cover availability, and the apparent lack of invertebrates for young birds' diets, possibly due to aerial spraying for mosquito control.

Wood duck nest box use has been steadily increasing, however, lack of brood habitat seems to be limiting survival. I may have inadvertently created an ecological trap for nesting wood ducks by providing nesting habitat without prerequisite feeding and brooding habitats. A greater effort will be made to check for wood duckling survival.

The use of goose pastures will be de-emphasized on Assawoman. The older pastures were never utilized to any degree, and the decline of the migratory portion of the Canada goose population has further reduced the need for pastures managed for goose forage. This fields will be converted from tall fescue to clover/switchgrass planted in strips. The edges of fields surrounding water bodies, e.g., Tony's Pond, have been allowed to grow up to provide more nesting and escape cover. These edges also provide valuable windbreaks and buffers against disturbance.

Phragmites will continue to be sprayed whenever it becomes invasive in valuable wildlife habitat. We have discovered that a two year spray program, even when supplemented with a burn, does not eliminate phragmites. The stunted stand persists at a lower density and must be monitored to prevent a similar problem.

Cattail has become a problem in some ponds , e.g., Sawmill Pond (1992), and should be sprayed when densities exceed acceptable levels. When Sawmill Pond was sprayed with 4 pints/acre of Rodeo in 1992, the stand was eliminated, but several valuable submersed plants flourished in its place (wigeongrass/spikerush).

Winter food (milo sorghum, corn, and winter wheat) planted for water fowl is attractive to deer. Deer damage on waterfowl foods has almost eliminated the food source some years (1989 - 1994). Although supplying winter food is important, management emphasis will shift to producing more submersed and emergent native plants within the impoundments, and less reliance on agricultural crops.

2. Impoundment Management

Since the first plan several major improvements have occurred. Two wells (1 - 4 inch and 1 - 8 inches) with electric submersible pumps and an interconnecting delivery system was installed in February 1991 between Mulberry and 65 Acre Ponds. A series of interconnecting ditches and ponds were excavated in the spring of 1991 within Mulberry, 65 Acre, and 35 Acre Ponds to improve circulation and enhance killifish survival during drawdowns. The Goose Pond water control structure was replaced with a better system in August 1993. The dikes at Mulberry and Goose Ponds were renovated and raised the same year. The wells, structure upgrades, and dike renovations were funding through the Ducks Unlimited M. A. R. S. H. program in Delaware. These projects were dedicated at an official ceremony at Mulberry Landing on May 15, 1991.

The Mulberry Pond structure has proven too short in length causing a constriction of the dike and creating a possible breach. This summer, the original pipe will be replaced with a pipe 18 feet longer to allow the dike to be widened.

The wells provide a source of practically fresh water (1 ppt. salinity) to reflood Mulberry and 65 Acre Ponds after drawdowns and maintain the proper degree of moisture to sustain aquatic plants under management. The Goose Pond structure's flapgates at either end of the pipe, allow controlled draining and flooding using tidal waters. A unique internal splashboard riser also permits water levels to be regulated. Plant response to the first drawdown was almost immediate.

The ditches and ponds located towards the center of the three impoundments (where no vegetation grew) did not hold their shape and eventually filled with sediment. With the exception of the ditches bisecting vegetated portions of the impoundments, this project was unsuccessful in improving water circulation and enhancing killifish survival for biological control of mosquitoes.

Each pond will be managed with a different set of techniques to achieve the following conditions:

65 Acre Pond - Winter waterfowl food production, spring migratory shorebird feeding habitat.
Zigzag Marsh and 35 Acre Pond - Waterfowl nesting habitat and winter feeding and resting sites for dabbling ducks and geese.
Mulberry Pond - Wintering and migratory waterfowl feeding habitat, muskrat habitat, wading bird feeding habitat, shorebird feeding habitat.
Goose Pond - Winter diving duck resting and feeding habitat.

Drawdown schedules used the past six years have generally followed this pattern: drawdown to lowest levels - March and April; begin re- flooding in mid-May and into June; maintain water levels sufficient to encourage growth without overtopping during summer and until mid-October; flood to deeper depths as waterfowl arrives. A slightly different approach will be taken in the next five years.

This approach will be the following: stagger drawdowns between ponds; attempt to delay drawdowns until late May and early June to encourage shorebird use; do not allow water levels to inundate the higher portions of impoundment vegetation for extended periods of time (> 4 days) following heavy rains or floods.

3. Waterfowl Hunting Program

One additional waterfowl blind was added on the Hickman Tract after its purchase in 1989. A handicapped accessible blind was built by Boy Scouts in 1993. Its use has been limited.

The waterfowl hunting program has been largely unchanged these past eight years. A daily drawing is used for all the blinds except the handicapped blind. A seasonal check station operator was hired to run the drawings starting in 1990. The use of a seasonal worker to run the drawing allowed me to use my permanent employees more efficiently. It eliminated costly overtime payments, asynchronous work schedules between individual employees and crews, better supervision and communication, better harvest reporting rates, better harvest data compilation, and less fatigue-related accidents. The cost is minimal (starting hourly rate of $5.50/hour) and the results good.

Handicapped hunters may reserve one day only through the statewide preseason lottery. Hunters must be wheelchair bound to qualify for use of the blind. They must be accompanied by a able -bodied helper. I have asked the handicapped hunters to call me before arriving to check on blind availability. No conflicts have arisen in two years (1993 - 1994).

Canvasback hunting resumed in 1994 - 95 (closed in 1986) with one bird per day the limit. Canada goose numbers were low enough in 1990 to force a season restriction (47 days) and a bag limit of one per day. Waterfowl harvest, hunting hours, and number of hunters at Assawoman for 1989 - 1994 are listed in the appendix (Appendix).

Mallard harvests continue to increase as the local non-migratory flock around the resort towns grows. Black duck harvest has declined proportionately. Pintails overwinter in significant numbers, but are not harvested appreciably.

4. Trends in Hunting Demand

Hunter demand increases each year. The addition of a blind in 1990 did not appreciably satisfy demand. No new blinds are planned due to lack of space, so demand is expected to outstrip supply. A daily drawing for blinds should be continued, except that handicapped waterfowl hunters should be allowed to reserve one day of hunting in the handicapped blind through the preseason lottery process. When hunter numbers begin to outnumber the blinds available, the preseason lottery should be used and supplemented with a daily drawing to fill unclaimed blinds.

Duck feeding by residents of local communities is putting hunters using state blinds in jeopardy for arrest on charges of hunting over bait. Development pressures will continue to impact the waterfowl hunting program.

5. Recommendations

1. Continue to maintain the impoundments as refuge.
2. Restore water level control to the impoundments and manage for winter food using drawdown techniques.
3. Install another well between 35 Acre and ZigZag Ponds to fine-tune the management of the impoundments.
4. Future increased demand for waterfowl hunting will not be met. There is no more room for waterfowl blinds. Additional land should be purchased. The addition of the lands presently owned by the Nature Conservancy north of Miller Creek near the mouth of the Assawoman Canal will provide the land needed. In addition, the purchase of the Tubbs property will add space to the west along Miller Creek.5. The demand for blinds has reached capacity during the most popular portions of the season - any weekend, first week, the day after Thanksgiving, and Christmas week. The daily drawing no longer appears to limit use.
6. Institute a half day hunts in the future (sunrise to 1 P.M.). The present system of checking blinds out until 1 P.M. reduces hunting pressure but does not allow the area to be "rested" from hunting.
7. Begin using the preseason lottery when overcrowding causes a waterfowl hunting party to be turned away more than five days a year.
8. Improve the checking procedure to include checks of waterfowl harvested on the area.
9. Continue to fund a seasonal check station operator.

C. White-tailed Deer Management Program

1. Surveys and status

Spotlight counts were run in the fall from 1990 - 1992 to determine herd densities. The survey had limited success due to the small size of the fields and high percentage of forested acres. Most deer were seen in the big fields within the refuge. Counts varied from 10 - 16 animals. The survey was discontinued in 1993.

Deer densities at Assawoman are higher than desired. Winter waterfowl food crops (milo, soybean, clover, corn, and winter wheat) are difficult to grow because of deer damage. The extent of the damage has increased every year since 1989. Last year no milo was left standing in early November, the month most waterfowl begin to arrive. I am considering not growing winter waterfowl crops in 1995.

2. Deer Hunting Program

Assawoman now has 40 deer stands. In 1993, twelve stands were moved to better spots. Handicapped deer hunting sites were expanded to three in 1993. All sites are within the refuge and are designed for in-vehicle hunting by persons carrying a permit to do so. Permits are issued by daily drawing during each firearms season. Permits are issued on a self sign-in basis after the drawing and during the archery season. Hunters are required to report harvest, deer observed, and hours hunted. The check station operator compiles the harvest and observational data. Harvest data (hunter's name, deer's size, sex, and age) is posted at the check station.

3. Trends in hunting demand

As Canada goose and quail populations dwindle, interest in small game hunting has declined. Luckily, the deer herd has expanded in Delaware, and much of the interest has turned to deer hunting. Demand for deer hunting on public lands has never been greater. The industrial forest lands public hunting lease program started in 1992 has helped satisfy some of the need. However, the deer hunting on these lands is more difficult compared to Assawoman, i. e., and no deer stands are provided. I anticipate that deer hunting demand will increase faster in the next 5 years.

More deer stands will be needed to meet demand for hunting on Assawoman. Some of those additional stands will be built to accommodate those hunters with physical impairments who are not wheelchair bound, e. g., cardiopulmonary dysfunction, cerebral palsy, and obesity. Some of the stands will be made to the same design to accommodate unimpaired hunters. In either case, safe and effective stands will become increasingly difficult to position. I believe that 10 regular, 3 secondary, 2 primary handicapped stands will be needed in the next five years.

4. Recommendations

a. Add 15 more deer stands within the next five years as listed above.

b. Continue to employ a seasonal check station operator to run the daily drawings and compile harvest data.
c. Encourage the Wildlife Section to maintain a state checking station in Dagsboro. Continue to collect harvest data from permits and cross reference to state check stations.

D. Small Game Management Program

1. Northern Bobwhite

a. Wildlife food and cover plots.

Although wildlife populations increase or decrease in response to management practices that affect vegetational succession, food plots have long been the "public's answer" to optimum wildlife habitat (Clark 1980). Although food plots are not a panacea to wildlife woes they do provide abundant, nutritional food during the "pinch" period, keep some areas in an annual stage of succession and increase wildlife viewing and hunting opportunities. The plots are utilized by several game and nongame species.

Wildlife food plots are planted in grains and grasses to provide both food and cover. Although the plots are referred to as food plots, they should be thought of as food and cover plots.

The wildlife food and cover plots will be planted within 50 feet of brushy cover. Recent research has suggested that food plots can act as predator traps if improperly located. Birds drawn to a food source are put at risk when avian predators such as Cooper's hawks begin keying on birds using food and cover plots. No effort to control "weeds" will be made in order to provide both food and cover upon the plots. The plots will be divided in half and put on a two year rotation. Fields smaller than one acre will not be divided, but will have grassy edge. Disked strips in the fallow half will encourage native annuals and expose bare soil for nesting and dusting. Each food plot will have a minimum of 25 feet of grass edge which will be disked or burned every 3-4 years.

b. Strip disking.

A better alternative to the traditional food plot is strip disking. Strip disking is simply disturbing the soil with a disk harrow to encourage native plants to grow. By disking at various times of the year, different plant communities prevail. Strips can be rotated to avoid disturbing the same ground each year, either in strips or blocks. Insects are attracted to disked strips more readily than farmed fields making them better brood habitat. Disking should be done from September 15 - April 31 (in areas not planted) to avoid disrupting nesting. Disked strips will be a minimum of 15 feet width. Additional advantages of strip disking include: not using inorganic fertilizers, pesticides, and herbicides; less equipment operation time; lower fuel and manpower costs; and minimization of disturbance to escape cover.

c. Prescribed burning.

Prescribed burning is one of the most economical procedures for manipulating wildlife habitat. Burning is used to reduce plant competition, prepare seed beds, stimulate regeneration of sprouts and seedlings, and create openings in dense stands. Low intensity fires increase both the quality and quantity of forage plans, seed-bearing plants, and insects (Schemnitz 1980).

Small fires that do not burn fast enough to trap wildlife will be used. Burning on Assawoman should be done between February 5 - April 31. Burning between these dates will make some seed for wildlife available during this time of food shortage, but take advantage of the soil moisture and temperatures common in the late winter. The following authorities will be notified before burning - the Fire Control Board (856-6306), Division of Air and Waste Management's Pollution Control Section (739-5072), Capitol Communication Room (1-800-523-3336), and the Wildlife Section Office in Dover (739-5297).

d. Edge plantings.

The following grasses are recommended for the edges of the wildlife food and cover plots : alfalfa, orchardgrass, clover (Trilobium spp.), reed canarygrass (Phalaris arundinacea), Korean lespedeza (Lespedeza stipulacea), switchgrass (Panicum virgatum), coastal panicgrass (Panicum amarum v. amarulum), or weeping lovegrass (). The seeding rate should be heavy enough to establish the stand, but light enough to create 50 % bare ground. Grasses which clump are best, e.g., switchgrass, coastal panicgrass, weeping lovegrass.

The soil fertility will be maintained using inorganic fertilizers according to soil test recommendations and long rotations. Soils will be tested every three years. Pesticide and herbicide use will minimized to the extent possible, and all restricted use herbicides will be eliminated from usage, e. g., Atrazine. Their use will only be considered when no other alternative is feasible.

e. Hedges.

Hedges can break large fields into smaller ones creating greater edge and escape cover near a food source. Hedges are living fences and serve as a physical and visual barriers. Wildlife use increases with less disturbance. Evergreens provide overhead cover during cold weather and give quail a place to escape avian predators and freezing rain or snow. Tree and shrub species that provide both cover and winter food are: Autumn olive (Elaeagnus augustifolia), amur honeysuckle (Lonicera maacki), barberry (Berberis spp.), silky dogwood (Cornus amomum), sumac, Japanese multiflora rose (Rosa multiflora), grape vines (Vitus spp.), VA-70 shrub lespedeza (Lespedeza thunbergii), and northern bayberry. Trees which provide some food for quail and could be planted in hedges (or favored during a timber harvest) are: black locust, American beech (Fagus grandifolia), sweetgum, pines (Pinus spp.), mulberry (Morus spp.), sassafras, and oaks (Quercus spp.) with small acorns, e.g. water and willow oaks.

f. Mowing.

Mowing sets back succession and stimulates new plant growth. The openings created provide travel lanes and sunning sites as well as shooting lanes for hunters. Strips mowed through brush create more edge by providing openings for sunning, dusting, and feeding. Mowing will be done before or after the nesting season. A predetermined lane can be mowed regularly and will discourage birds from nesting in the short grass and reduce losses to the mower.

Quail Habitat Recommendations.

The following recommendations will be incorporated in manipulating quail habitat:

1. No mowing or tilling within 50 feet of field edges during mid-May and June to avoid disrupting nesting.

2. Field edges with more than 50 % ground cover will be burned or disked in February, March, or April.

3. Roadsides will not be sprayed or mowed unless deemed necessary for safety or public access. Any mowed areas will be kept short to discourage nesting attempts in areas likely to cause physical harm.

4. Controlled burns of food plots, fields, or woods will be done between February 15 - April 1.

5. Crops will be left standing except in dove fields. Mowed strips beside crops will be maintained throughout the growing season to create shooting lanes and allow dog training access.

6. Strips at least 15 feet wide should be disked in the fallow food plots to encourage annual food plants and improve nesting cover. Strips should be disked before burning grass edges to protect nesting cover.

7. Grass edges will be burned every three years or when less than 50 % bare ground shows.

8. A minimum of 25 feet wide grass edge will be left on either side of a hedge unless the hedge borders a woods-then only one side needs grass.

9. The woodlands will be managed as small even aged stands managed on long rotations to provide a continuum of age classes. Saw log production will be half of optimum to maintain a 60 % crown closure. Loblolly Pine will be managed on 75 year rotations.

10. Prescribed burns will be an integral part of woodland management.

2. Eastern Cottontail

Rabbits have very small home ranges (less than five acres) and spend most of their lives within 150 feet of dense brushy cover. Rabbits need grass for nesting cover; grasses and legumes for food; and dense brush and vines for escape and winter food.

The habitat and low densities of cottontails on the area make management of cottontails difficult. Clover strips for deer benefit cottontails. Greenbriar patches, small phargmites stands, and brushy areas adjacent to wetlands seem to hold rabbits. Outside of reduced mowing, fallow disking, and clover plantings, no special provisions are made for rabbits at Assawoman.

3. Delmarva Fox and Gray Squirrels

No major changes in squirrel management are proposed for this revision. Severe damage to oak stands during the summers of 1994 and 1995 will impact squirrel densities. All areas outside of a quarter mile from the bald eagle nest were sprayed with Bt this spring, but defoliation was near 100 % in most places. The nestbox program will continue for the Delmarva fox squirrels.

Other than spring burning, no special management practices have been initiated for squirrels. The open park-like conditions needed by Delmarvas are present along Strawberry Landing and near Tony's Pond in the refuge. Both sites have been burned within the past two years. Alot of the loblolly pine is large, and appears to be beetle damaged. Some harvest may be necessary, but I will consult with the fox squirrel recovery team beforehand.

Update: Since the first plan was written, several management techniques have been changed. We no longer trap and release. Nest boxes with hinged sides were added in 1992 along Strawberry Landing and in the woods south of Tony's Pond in the refuge (25 total boxes). The boxes are checked at night in early spring. In 1992 3 squirrels were found, and 4 Delmarvas were found in 1995. The squirrels are sleeping in the boxes, so disturbance is minimized. No mortalities occurred using the night box checks. Any unmarked animals are ear-tagged, weighed, and returned to the box within 30 minutes. Delmarvas have been found each year the surveys were run.

Recommendations for Squirrel Habitat.

Delmarva Fox Squirrels

1. Use controlled burns to maintain an open forest floor in the woods near Tony's Pond and along the Strawberry Landing Road, where Delmarva have been trapped and are known to habituate.

1. Survey areas for den tree densities and determine if natural den sites are limiting.
2. Install more nest boxes in areas with less than 3 den trees per acre.
4. Continue to check the nest boxes (installed in 1984 and checked since 1986, modified in 1992 trapping was discontinued).
5. Eliminate winter trapping to reduce mortality rates.

6. Explore the feasibility of future supplemental releases. As of the fall of 1987, a scheduled release was postponed when our source of squirrels wanted compensation for the squirrels. Twelve more squirrels were scheduled for a future release.

7. Identify other potential release sites on Assawoman and determine if any habitat modifications are necessary.

Gray Squirrels

1. Manage for Grays in the Oak/Pine stands within the area and leave the mature Loblolly Pine stands for the Delmarvas.

2. Create a favorable balance of mast-producing trees when replanting future timber harvest sites.

3. Identify and save den trees prior to any future timber sale.

4. Explore the feasibility of reopening the gray squirrel season outside of the release sites.

Recommendations for Small Game Hunting Program

Small game densities are sufficient to support a hunting program on Assawoman. Bobwhite densities are stable and probably near carrying capacity for the existing habitat. Cottontails are limited by the absence of nesting and winter cover. Gray Squirrels are plentiful in the areas with good mast production, but limited in pure Loblolly Pine stands.

Clean farming and an expanding residential human population in the County will create an imbalance between a demand for and the supply of rabbits and quail. This situation will inevitably bring more small game hunters to the Area. Small game densities are insufficient to support an increased demand for quail and rabbit hunting opportunities. Any attempts to increase quail and rabbit numbers will involve increased edge probably as a result of a timber sale. The potential for timber harvesting is limited. Any attempt to increase small game will involve trade-offs with nonconsumptive uses. Small game will continue to be managed as a secondary resource to waterfowl and deer.

Since the inception of the permit system for small game hunting, relatively accurate records that dove, quail, rabbit, and woodcock are the four species most sought after (in descending order of harvest). Harvest seems to reflect the number of hunter hours, more than relative abundance, although no statistical analyze was undertaken due to the small sample size.

Permits were carried on their person while hunting and returned to the checking station after the hunt. Compliance was good the first year. Hunters seeking rabbit, quail, woodcock, mourning dove, opossum, raccoon, and fox are required to carry a permit.

C. Access.

Access to the Wildlife Area comes from County Roads 364 and 363 (a paved two lane secondary road). Six and a half miles of dirt road traverse the area. The area is closed each night from sunset to 7 A. M. A sign stating that the area is closed if the bulletin board lights are one is displayed at the entrance. Area maps are available to the public at the Checking Station by the main gate. A copy is posted in the Bulletin Board display as well.

D. Refuges and Closed Areas.

A portion of the Wildlife Area was set aside as a refuge sometime after the area was established in 1943. It is not known when the refuge was established.

The refuge was established as a waterfowl sanctuary to encourage flocks of waterfowl to overwinter. When Delmarva Fox Squirrels were reintroduced, they became a secondary protected species. Three impoundments and a pond are included within the confines of the refuge. However since all waterfowl hunting must be confined to the blinds along the bayfront, all the impoundments are in essence "refuges". Other types of upland hunting are permitted around the ZigZag, Mulberry, and 35 Acre Ponds, but no "jump shooting" for waterfowl is allowed.

The boundary is clearly marked with red and white Refuge signs. The two access roads into the refuge are posted with large wooden signs denoting the area's status.

Activities related to the operation of the Area occurs within the refuge including farming food and cover plots, mowing, checking water control structures, prescribed burning, conducting deer spotlight counts, and checking nest boxes. The disturbance is minimal and the waterfowl seem to habituate to the vehicles seen daily. Unrestricted access is unacceptable and contrary to accepted wildlife management principles.

Certain activities will be allowed with a permit issued from the Regional Manager's office if closely supervised by area personnel: bird counts by bona-fide ornithological groups, biological surveys such as mosquito larvae counts, hydrologic sampling, and guided group tours. A special exception has been made for handicapped deer hunters to provide equal access to handicapped hunters while accomplishing deer herd reductions within the refuge.

XI. Wildlife Surveys and Inventories.

A detailed record of animal and plant surveys is useful to document the results of existing wildlife management practices, highlight the need for corrective actions, to protect past practices, and provide continuity in the event of personnel changes.

A. Nest Box Surveys

Wood Duck

Assawoman presently has 24 wood duck boxes. The boxes are equally represented between wood and plastic designs. All are protected with metal predator guards. Nesting success has increased in time. See Appendix for a more detailed account of box use.

Following the U. S. Fish and Wildlife Service's protocol, the boxes are checked every 40 days starting in mid May. This schedule minimizes disturbance, but provides a reliable census.

Squirrels - Gray and Delmarva Fox.

Twenty squirrel nest boxes are located on the area, either along Strawberry Landing Road or within the refuge south of Tony's Pond. The survey is done at night during the late winter or early spring to minimize disturbance, check production, and eliminate the trapping surveys of the past which resulted in mortality. A crew of four people can complete the survey in five hours. See Appendix for results and a map of box locations.

Bluebirds (Sialis sialis)

Thirty boxes are checked biweekly throughout the summer beginning May 1 each year. Use has been high by various species, including bluebirds, tree swallows, house wrens, and chickadees. See Appendix for a summary of the nesting data and a map of the box locations.

Purple Martin (Progne subis)

An aluminum multi-compartment martin house designed and built by a local individual was installed in 1994 in Field 1. To date, no martins have used the house. Another commercial house donated by Delaware Audubon Society was installed on Mulberry Dike in 1994 with the same lack of results.

Bobwhite

The call count was discontinued in 1993 after years of seemingly uncorrelated results. The count will be resumed in 1995 and compared to complete counts done on the wildlife areas. An individual will start from a pre-selected starting point and listen 5 minutes, then travel one half mile and repeat the count. Counts on the wildlife area will be conducted to count all singing males during June and July. It is hoped that the effectiveness of a more intensive quail management program can be evaluated using the call count.

Breeding Birds

Two counts done by members of the Delaware Ornithological Society are used to track songbird populations on Assawoman - the Christmas and the Spring counts. Both are complete counts, done simultaneously on all parts of the area and other parts of the state. Results will be stored in the files of the regional office.

Osprey (Pandion haliatus)

Nest surveys done by the Delaware Nongame and Endangered Species Program (NGESP) coordinator will be included within the plan.

Bald Eagle

Area personnel contribute data to the mid winter bald eagle survey done each year by the NGESP Office. The survey is usually done during the first week of January each year. A bald eagle nest was found this year (1995) along Miller Creek. The pair might have nested here in 1994 without anyone knowing about the nest. Nesting records are kept by the NGESP.

Waterfowl Brood Counts

Beginning in early April each year, an informal brood counts will be performed by area personnel.

B. Wildlife Inventories

Wildlife Food and Cover Plot Management

Written records of food plot management practices describing the chronology of plantings and treatments was started in 1986. The information will be used to establish crop rotations and plan future crops. Records of the time of mowing, planting, disking, plowing, fertilizing, planting, and burning are logged in the Food Plot History Form. Seeding and fertilizing rates are recorded to evaluate soil fertility and crop suitability on each plot.

Burning and Spraying Records

The effects of prescribed burns on food and cover plots, woods, and marsh vegetation will be recorded to help plan future habitat manipulations.

Phragmites control is an integral part of the impoundment management program. To better coordinate the planning of future spraying efforts, records of spraying rates and location and effectiveness will be kept in the Management Plan.

Other aquatic plants

The effects of drawdowns on the emergent and submersed plants will be monitored and evaluated by surveying the ponds each year. The results will be kept in a bound Field Note.

Forest Management Plan

The recommendations of the Delaware State Forest Service in the form of a Forestry management Plan will be included with this plan upon completion. The forest management plan will include a timber cruise which describes the forest by forest type, relative species composition, timber volume and market value. Using these surveys and economic predictions as a rough guideline, the regional biologist can integrate wildlife and forestry objectives into an acceptable format for a Wildlife Area.

XII. Measures for testing the effectiveness of the Plan.

A. Harvest Data.

Harvest data for waterfowl and deer can provide valuable data for managing the wildlife populations. The existing permit system is adequate provided the data is reported accurately and precisely. This permit system has been continued with the following modifications:

1. Actual harvest is randomly checked against reported harvest by comparing deer harvest reports at Assawoman with the Dagsboro station.
2. Hunters are rewarded for accurate, precise harvest data by seeing harvest results displayed where they return the permits.
3. Hunters who fail to return permits are punished by losing hunting privileges.

3. Small game hunting is now regulated with permits and harvest is reported on the permits.

B. Surveys and Inventories.

The following list of surveys and inventories has previously been described. They will be used to measure the effectiveness of the proposed management plan.

1. Harvest records for waterfowl, deer, and small game.
2. Delmarva Fox Squirrel nest box checks.

3. Qualitative survey of plants growing in the impoundments.
4. Waterfowl aerial surveys.
5. Waterfowl brood counts. Wood Duck nestbox surveys.
6. Wildlife food and cover plot history records.
7. Prescribed burning and spraying records.
8. Breeding bird surveys.
9. Breeding amphibian and reptile survey.

A measure of the effectiveness of the area wildlife management practices is the number of people using the area and their level of satisfaction. Assawoman attracts people interested in both wildlife and fisheries recreational opportunities. A meaningful user survey must be designed to sample all participants.

A two part survey is proposed. Hunters will be surveyed at the checking station. The surveys will be distributed with the permits. The nonconsumptive public, i.e., people using the fishing areas, will be surveyed by distributing the survey at the entrance. A seasonal employee might be retained to handle weekend surveys. The results of the survey could be included within the Plan or a public meeting called to discuss the alternatives. A suggestion box placed near the entrance might be another effective way to measure the level of satisfaction of the public with management practices.

C. Periodic Review of the Wildlife Management Plan

The Wildlife Management Plan will be reviewed and revised, if necessary, every ten years. Public involvement will be encouraged through periodic review by the Fish and Game Advisory Council and revisions by the Division of Fish and Wildlife. The Plan will become a "living document" by adding current information and storing survey results within the appendix of the plan.

Statewide plans for critical species and habitats are needed to augment the individual area plans. The first such plan was developed for northern bobwhites in 1994. Wildlife Areas should be managed as representatives of an ecosystem, however, the objectives of the Area Plan should be subordinate to the goals of an ecosystem management plan.

XIV. Special Equipment Needed.

The need for a pole barn described in the first plan was satisfied upon its completion in-house in 1992. The wells were installed as planned, including a new water control structure at Mulberry Dike, and the Goose Pond.

Several major projects need to be addressed in the next ten years including a second well at Zig-Zag Marsh, a new water control structure and dike renovation at Mulberry Pond, extending the

pipe at Mulberry Landing, repairing the chimney at Strawberry Landing, paving part of the main road, and building a regional headquarters outside the state residence.

XVI. APPENDIX

Table 2. Habitat types at Assawoman by acres and percent

FORESTED	723.3	Acres	49.3 %
IMPOUNDMENTS	264.1	"	18.0 %
SALT MARSH	247.9	"	16.9 %
BARRIER ISLAND	75.8	"	5.2 %
FOOD PLOTS	45.6	"	3.1 %
FRESHWATER PONDS	34.7	"	2.4 %
CAMP BARNES COMPLEX	9.1	"	0.5 %
SANDPITS	2.6	"	0.1 %
BUILDINGS, ROADS	65.3	"	4.5 %
GRAND TOTAL	1468.4		100.0 %

Table 3. Ducks and Geese in Survey Unit 11 during October 1977-1987 - results of winter aerial counts.

	YEAR										
SPECIES	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
B.DUCK	1320	201	229	130	625	331	1172	345	45	238	86
MALLARD	150	51	11	15	435	211	195	105	50	207	47
PINTAIL	550	15	150	5	1450	500	500	210	80	154	32
G.W. TEAL	0	540	208	175	150	460	665	290	290	50	150
B.W. TEAL	0	0	0	0	0	0	0	4	10	0	0
WOOD DUCK	0	8	5	37	0	0	0	0	0	0	0
GADWALL	0	18	7	3	0	35	50	65	0	33	20
SHOVELER	0	0	0	0	0	0	0	0	0	0	0
A. WIDGEON	100	10	55	2	0	0	25	25	0	50	0
BUFFLEHEAD	0	0	0	0	0	0	0	0	0	0	0
CANVASBACK	0	0	0	0	0	0	0	0	0	0	0
RUDDY	0	0	75	225	250	0	150	0	0	0	0
SNOW GEESE	0	0	7	0	0	0	0	0	0	0	0
C. GEESE	1730	400	335	225	550	240	625	300	185	570	20
TOTAL	3850	1243	1082	1202	3460	1777	3382	999	660	1302	355

Table 4. Ducks and Geese in Survey Unit 11 during November 1977-1987- results of winter aerial counts.

	YEAR										
SPECIES	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
BLACK DUCK	1134	386	1255	962	1994	834	960	497	664	435	857
MALLARD	870	103	968	408	2	220	1330	938	600	205	225
PINTAIL	50	270	0	175	1310	942	1200	350	500	302	300
G.W. TEAL	0	195	0	200	450	50	150	0	700	0	50
GADWALL	50	0	10	0	20	20	200	0	0	10	0
SHOVELER	0	20	0	0	0	0	0	5	0	0	0
A. WIDGEON	25	0	0	0	0	0	200	50	0	20	0
BUFFLEHEAD	0	85	10	47	3	17	0	1	0	10	20
CANVASBACK	500	305	400	400	600	0	100	0	0	0	0
RUDDY	50	75	0	30	0	30	0	0	0	0	0
SNOW GEESE	1000	810	0	0	0	0	0	0	0	0	5
C. GEESE	800	750	560	319	850	40	1400	1830	55	1450	110
TOTAL	4479	2999	3203	2541	5229	2153	5540	3671	2519	2432	1567

NOTE; No individuals of the following species were present during the preceding surveys: Blue-winged Teal, Wood Ducks, Common Goldeneye, Redheads, Ringnecks, Mergansers, Greater or Lesser Scaup, Scoters, Old Squaws, Atlantic Brant, or Coots.

Table 5. Ducks and Geese in Survey Unit 11 during December 1977-1987 - results of aerial counts.

	YEAR										
SPECIES	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
BLACK DUCK	936	867	1448	2203	2207	858	1674	1757	319	632	1230
MALLARD	365	461	838	1500	1153	2	1280	902	275	1021	1515
PINTAIL	325	50	151	1350	901	1005	835	350	500	800	100
G. W. TEAL	0	70	50	250	0	0	150	10	0	0	0
GADWALL	0	50	0	50	30	100	10	0	0	150	0
SHOVELER	50	5	0	0	0	0	0	0	0	50	0
A. WIDGEON	0	0	0	50	100	0	30	50	0	0	0
BUFFLEHEAD	7	156	0	24	8	0	15	0	3	0	9
C. GOLDENEYE	3	88	0	0	1	0	0	0	0	0	0
CANVASBACK	400	55	3	800	800	0	0	200	0	0	0
SCAUP	200	0	200	0	0	0	0	0	0	0	0
RUDDY	0	0	0	50	0	0	0	100	0	0	0
SNOW GEESE	20	30	0	0	20	0	0	3000	0	0	0
CANADA GEESE	690	535	500	550	169	590	1030	870	560	1093	620
TOTAL	2996	2367	3190	6827	5389	2555	5024	7239	1657	3746	3474

Table 6. Ducks and Geese in Survey Unit 11 during January 1977-1987 - results of aerial counts.

	YEAR										
SPECIES	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987
BLACK DUCK	1518	292	1758	1910	1303	1133	1700	1944	1125	820	728
MALLARD	710	155	22	560	400	766	1609	1440	660	160	867
PINTAIL	25	10	120	11	0	100	0	200	350	0	0
GADWALL	0	0	0	0	0	0	0	50	0	8	0
SHOVELER	0	0	0	0	0	0	0	35	0	0	0
A. WIDGEON	0	0	0	0	0	5	0	50	0	0	0
BUFFLEHEAD	93	0	20	0	0	3	0	60	0	0	0
C. GOLDENEYE	54	0	0	0	0	1	10	25	0	2	0
CANVASBACK	25	70	150	150	400	0	0	235	0	5	0
SCAUP	150	0	5	0	0	250	0	0	0	0	0
RUDDY	0	0	375	0	0	10	0	245	0	1100	0
SNOW GEESE	0	0	950	0	0	0	0	0	0	0	0
CANADA GEESE	763	923	885	510	842	1208	1052	400	1300	825	445
TOTAL	3338	1475	4258	3141	2945	3476	4371	4684	3435	2920	2040

Table 7. Waterfowl harvest, crippling loss, and hunter use daysat Assawoman since 1975.

YEAR	HARVEST	CRIPPLING LOSS	HUNTER USE DAYS
1975	129	18	337
1976	156	12	203
1977*	400	231	530
1978	282	85	786
1979	253	45	659
1980	155	52	484
1981	302	30	600
1982	234	34	555
1983	258	70	580
1984	181	42	556
1985	413	94	695
1986	286	55	697
1987	261	38	542

* First year that steel shot was required.

WILDLIFE SPECIES CHECKLIST

KEY TO ABBREVIATIONS

WHEN

YR - Year-round resident.
SFM - Spring or fall migrant
W - Winters only
S - Summers only
? - Unknown

ABUNDANCE

C - Common
U - Uncommon
R - Rare
E - Endangered
T - Threatened
? - Unknown

MAMMALS

SPECIES	PRESENT	WHEN	ABUNDANCE
WHITE-TAILED DEER	YES	YR	C
GRAY SQUIRREL	YES	YR	C
EASTERN COTTONTAIL	YES	YR	C
RACCOON	YES	YR	C
OPOSSUM	YES	YR	C
STRIPED SKUNK	YES	YR	U
RED FOX	YES	YR	C
GRAY FOX	YES	YR	C
RIVER OTTER	YES	YR	C
MUSKRAT	YES	YR	C
LEAST WEASEL	?		
WOODCHUCK	NO		
BEAVER	NO		
SHORT-TAILED SHREW	?		
MEADOW VOLE	YES	YR	C
STAR-NOSED MOLE	?		
EASTERN MOLE	YES	YR	?
MASKED SHREW	YES	YR	?
WHITE-FOOTED MOUSE	YES	YR	
DEER MOUSE	?		
WOODLAND JUMPING MOUSE	?		
DELMARVA FOX SQUIRREL	YES	YR	RE
RED SQUIRREL	NO		
SOUTHERN FLYING SQUIRREL	YES	YR	C
MINK	?		
SHORT-TAILED WEASEL	?		
COTTON RATS	YES	YR	C

SPERM WHALE	NO	?	E
BLUE WHALE	NO	?	E
FINBACK WHALE	NO	?	E
SEI WHALE	NO	?	E
HUMPBACK WHALE	NO	?	E
RIGHT WHALE	NO	?	E

BIRDS

NORTHERN BOBWHITE	YES	YR	C
RING-NECKED PHEASANT	NO		
WILD TURKEY	YES	YR	U
MOURNING DOVE	YES	YR	C
PIED-BILLED GREBE	YES	W	U
AMERICAN BITTERN	YES	SFM	U
LEAST BITTERN	NO		
GREAT BLUE HERON	YES	YR	C
GREAT EGRET	YES	S/SFM	U
SNOWY EGRET	YES	S/SFM	C
GREEN-BACKED HERON	YES	YR	C
BLACK-CROWNED HERON	YES	SFM	R
YELLOW-CROWNED HERON	YES	SFM	U
GLOSSY IBIS	YES	S/SFM	U
TUNDRA SWAN	YES	W/SFM	U
MUTE SWAN	YES	SFM/YR	C
CANADA GOOSE	YES	W/SFM/YR	C
SNOW GOOSE	YES	W	C
WOOD DUCK	YES	S/SFM	C
AMERICAN BLACK DUCK	YES	YR/SFM/W	C
MALLARD	YES	YR/SFM/W	C
BLUE-WINGED DUCK	YES	SFM	R
GREEN-WINGED DUCK	YES	SFM	C
GADWALL	YES	SFM	U
NORTHERN PINTAIL	YES	SFM	C
SHOVELER	YES	SFM	U
AMERICAN WIDGEON	YES	SFM	U
RUDDY DUCK	YES	SFM/W	C
CANVASBACK	YES	SFM/W	C
REDHEAD	YES	W	R
RINGNECK	YES	SFM/W	U
GREATER SCAUP	YES	SFM/W	U
LESSER SCAUP	YES	SFM/W	C
BUFFLEHEAD	YES	SFM/W	C
GOLDENEYE	YES	SFM/W	U

COMMON MERGANSER	YES	SFM/W	C
HOODED MERGANSER	YES	SFM	U
RED-BREASTED MERGANSER	YES	SFM/W	U
OLDSQUAW	YES	W	R
BLACK SCOTER	YES	SFM	R
SURF SCOTER	NO		
WHITE-WINGED SCOTER	NO		
ATLANTIC BRANT	YES	SFM/W	U
BLACK VULTURE	YES	SFM/W	C
TURKEY VULTURE	YES	YR	C
BALD EAGLE	YES	YR/SFM	R/T
OSPREY	YES	S/SFM	C
NORTHERN HARRIER	YES	SFM/W	C
RED-SHOULDERED HAWK	YES	SFM	U
RED-TAILED HAWK	YES	YR	C
BROAD-WINGED HAWK	YES	SFM	U
AMERICAN KESTREL	YES	YR	C
MERLIN	YES	SFM	U
PEREGRINE FALCON	YES	SFM	R/E
SHARP-SHINNED HAWK	YES	SFM/YR	C
COOPER'S HAWK	YES	SFM	C
GOSHAWK	?	SFM	?
BLACK RAIL	?		
CLAPPER RAIL	YES	S/SFM	C
KING RAIL	?		
VIRGINIA RAIL	YES	SFM	?
SORA	?		
COMMON MOORHEN	NO		
AMERICAN COOT	YES	W/SFM	U
PIPING PLOVER	NO	S/SFM	E
KILLDEER	YES	S/SFM	C
AMERICAN OYSTERCATCHER	YES	SFM	R
BLACK-NECKED STILT	YES	SFM	R
WILLET	YES	YR	C
SPOTTED SANDPIPER	YES	SFM	C
AMERICAN WOODCOCK	YES	S/SFM/W	C
LAUGHING GULL	YES	YR	C
HERRING GULL	YES	SFM/W	C
RING-BILLED GULL	YES	YR	C
GULL-BILLED TERN	?		
COMMON TERN	YES	YR	C
FORSTER'S TERN	YES	YR	C
LEAST TERN	YES	S	C
BLACK SKIMMER	YES	S	C
ROCK DOVE	YES	YR	C

BLACK-BILLED CUCKOO	YES	S	U
YELLOW-BILLED CUCKOO	YES	S	C
COMMON BARN OWL	?		
EASTERN SCREECH OWL	YES	YR	C
GREAT HORNED OWL	YES	YR	C
BARRED OWL	NO	YR	U
COMMON NIGHTHAWK	YES	S/SFM	C
CHUCK-WILL'S WIDOW	YES	S	C
WHIP-POOR WILL	YES	SFM	C
CHIMNEY SWIFT	YES	S	C
RUBY-TH. HUMMINGBIRD	YES	S	C
BELTED KINGFISHER	YES	S	C
RED-HEADED WOODPECKER	YES	W	U
RED-BELLIED WOODPECKER	YES	YR	C
DOWNY WOODPECKER	YES	YR	C
HAIRY WOODPECKER	YES	YR	C
NORTHERN FLICKER	YES	YR	C
PILEATED WOODPECKER	YES	YR	U
EASTERN WOOD PEWEE	YES	S	C
ACADIAN FLYCATCHER	YES	SFM	U
WILLOW FLYCATCHER	?		
LEAST FLYCATCHER	YES	S	U
EASTERN PHOEBE	YES	S	C
GREAT CRESTED FLYCATCHER	YES	S	C
EASTERN KINGBIRD	YES	S	C
HORNED LARK	YES	S	C
PURPLE MARTIN	YES	S/SFM	C
TREE SWALLOW	YES	S/SFM	C
N. ROUGH-WINGED SWALLOW	?		
BANK SWALLOW	NO	S	C
BARN SWALLOW	YES	S	C
BLUE JAY	YES	YR	C
AMERICAN CROW	YES	YR	C
FISH CROW	YES	YR	C
CAROLINA CHICKADEE	YES	YR	C
BLACK-CAPPED CHICKADEE	?		
TUFTED TITMOUSE	YES	YR	C
WHITE-BREASTED NUTHATCH	YES	S	U
BROWN-HEADED NUTHATCH	YES	S	U
RED-BREASTED NUTHATCH	YES	S	U
CAROLINA WREN	YES	YR	C
HOUSE WREN	YES	S	C
SEDGE WREN	?		
MARSH WREN	YES	S	C
BLUE-GRAY FLYCATCHER	YES	SFM	U

EASTERN BLUEBIRD	YES	YR	C
VEERY	YES	SFM	C
WOOD THRUSH	YES	S/SFM	C
AMERICAN ROBIN	YES	YR	C
GRAY CATBIRD	YES	S	C
NORTHERN MOCKINGBIRD	YES	S	U
BROWN THRASHER	YES	S	C
CEDAR WAXWING	YES	S	U
EUROPEAN STARLING	YES	YR	C
WHITE-EYED VIREO	YES	S	C
YELLOW-THROATED VIREO	?		
WARBLING VIREO	?		
SOLITARY VIREO	YES	SFM	U
RED-EYED VIREO	YES	S	C
BLUE-WINGED WARBLER	YES	SFM	U
TENNESSEE WARBLER	YES	SFM	U
NORTHERN PARULA	YES	SFM	C
YELLOW WARBLER	YES	SFM	C
CHESTNUT-SIDED WARBLER	?		
MAGNOLIA WARBLER	YES	SFM	U
CAPE MAY WARBLER	YES	SFM	U
BLACK-THROATED BLUE W.	YES	SFM	C
YELLOW RUMPED WARBLER	YES	SFM	C
BLACK-THROATED GREEN W.	YES	SFM	U
YELLOW-THROATED WARBLER	YES	SFM	U
PINE WARBLER	YES	S	C
PRAIRIE WARBLER	YES	SFM	C
BLACKPOLL WARBLER	YES	SFM	U
CERULEAN WARBLER	?		
BLACK AND WHITE WARBLER	YES	SFM	C
AMERICAN REDSTART	YES	SFM	U
PROTHONOTARY WARBLER	?		
WORM-EATING WARBLER	YES	SFM	R
SWAINSON'S WARBLER	?		
OVENBIRD	YES	S/SFM	C
LOUISIANA WATERTHRUSH	?		
NORTHERN WATERTHRUSH	NO		
KENTUCKY WARBLER	YES	SFM	U
COMMON YELLOWTHROAT	YES	S	C
HOODED WARBLER	?		
YELLOW-BREASTED CHAT	YES	S	U
SUMMER TANAGER	NO	SFM	?
SCARLET TANAGER	YES	S	U
NORTHERN CARDINAL	YES	YR	C
BLUE GROSBEAK	YES	S	C

INDIGO BUNTING	YES	SFM	C
RUFOUS-SIDED TOWHEE	YES	YR	C
CHIPPING SPARROW	YES	YR	C
FIELD SPARROW	YES	YR	U
SAVANNAH SPARROW	YES	SFM	C
VESPER SPARROW	NO		
GRASSHOPPER SPARROW	NO		
HENSLOW'S SPARROW	NO		
SHARP-TAILED SPARROW	YES	S	U
SEASIDE SPARROW	YES	YR	C
SONG SPARROW	YES	YR	C
SWAMP SPARROW	YES	YR	U
RED-WINGED BLACKBIRD	YES	YR	C
EASTERN MEADOWLARK	YES	W/SFM	C
BOAT-TAILED GRACKLE	YES	S	C
COMMON GRACKLE	YES	YR	C
BROWN-HEADED COWBIRD	YES	YR	C
ORCHARD ORIOLE	YES	SFM	U
NORTHERN ORCHARD	YES	S	U
HOUSE FINCH	YES	YR	C
AMERICAN GOLDFINCH	YES	YR	C
HOUSE SPARROW	YES	YR	C
BROWN PELICAN	YES	S	T

REPTILES

COMMON SNAPPING TURTLE	YES		C
BOG TURTLE	?		E
WOOD "	?		R
SPOTTED "	YES	C	
STINKPOT	?		C
EASTERN MUD "	YES	C	
N. DIAMONDBACK TERRAPIN	YES		?
EASTERN PAINTED TURTLE	YES		C
EASTERN BOX "	YES	C	
HAWKSBILL SEA TURTLE	NO		E
LEATHERBACK SEA TURTLE	NO		E
KEMP'S RIDLEY SEA TURTLE	NO		E
GREEN TURTLE	NO		T
LOGGERHEAD TURTLE	NO		T
NORTHERN FENCE LIZARD	YES		C
S. E. FIVE-LINED SKINK	YES		C
BROAD-HEADED SKINK	?		
SIX-LINED RACERUNNER	?		R

NORTHERN WATER SNAKE	?	C
RED-BELLIED SNAKE	?	U
EASTERN GARTER "	YES	C
EASTERN RIBBON "	?	?
E. SMOOTH EARTH "	?	R
N. RED-BELLIED "	?	U
N. BROWN "	?	?
EASTERN HOGNOSE	YES	C
EASTERN WORM "	?	?
NORTHERN RINGNECK "	YES	?
SOUTHERN " "	?	?
ROUGH GREEN "	?	?
NORTHERN BLACK RACER	YES	C
BLACK RAT SNAKE	YES	C
CORN "	?	?
NORTHERN SCARLET "	?	?
EASTERN MILKSNAKE	?	C
EASTERN KINGSNAKE	YES	?
NORTHERN COPPERHEAD	YES	U

AMPHIBIANS

RED-SPOTTED NEWT	NO	C
EASTERN TIGER SALAMANDER	NO	E
SPOTTED "	NO	?
MARBLED "	YES	U
NORTHERN DUSKY "	NO	C
EASTERN MUD "	?	?
RED-BACKED "	YES	C
FOUR-TOED "	?	?
NORTHERN TWO-LINED "	?	?
EASTERN SPADEFOOT TOAD	YES	U
E. NARROWMOUTHED TOAD	?	R
AMERICAN TOAD	NO	R
FOWLER'S TOAD	YES	C
SPRING PEEPER	YES	C
GREEN TREEFROG	YES	C
COPE'S GRAY TREEFROG	?	U
GRAY TREEFROG	YES	C
NEW JERSEY CHORUS FROG	YES	C
NORTHERN CRICKET FROG	?	?
GREEN FROG	YES	U
BULLFROG	YES	C
SOUTHERN LEOPARD FROG	YES	C

PICKEREL FROG	?	?
WOOD FROG	YES	C
CARPENTER FROG	NO	?

Table 8. Black Duck and Mallard harvest at Assawoman - 1976 to 1994.

	BLACK	MALLARD
1976	39	17
1977	37	19
1978	42	35
1979	27	33
1980	43	60
1981	44	58
1982	43	47
1983	46	64
1984	24	32
1985	69	72
1986	36	60
1987	58	57
1988	72	79
1989	155	223
1990	66	107
1991	98	124
1992	58	197
1993	84	221
1994	71	167
TOTAL	1112	1672
MEAN	58.5	88.0

Table 9. Canada Goose harvest at Assawoman - 1976 - 1994.

YEAR	CANADA GEESE HARVESTED
1976	24
1977	93
1978	44
1979	17
1980	34
1981	48
1982	23
1983	67
1984	33
1985	30
1986	74
1987	67
1988	64
1989	66
1990	47
1991	37
1992	30
1993	23
1994	18
TOTAL	839
MEAN	44.2

Table 11. Waterfowl Blind and Deer Stand Repair Checklist.

DUCK BLIND/DEER STAND CONDITION CHECK

Wildlife Area _____

Tract _____

Employee Name _____

Date _____ 19 _____

Duck Blind/Deer Stand Number _____

Is the approach to the blind/stand free of obstructions? _____

Is the blind/stand securely anchored in the ground ? _____

Are the steps or door in good condition ? _____

Are all support boards securely fastened ? _____

Is the floor intact and sound ?_____

Are the roof and sides in disrepair ? _____

Is the blind or stand level and capable of supporting itself ?__

Is the seat secure ? _____

Is the railing secure ? _____

Are there any exposed nails ? _____

Is the stand/blind safe to use for the upcoming season ? _____

If any of the above answers are no , state here the date and
type of corrective action taken:
_____
_____

Table 12. Nest Box Survey Form.

DELAWARE DIVISION OF FISH AND WILDLIFE
NEST BOX SURVEY FORM

Wildlife Area _____

Tract _____

Employee Name _____

Date _____ 19 _____

Type of box _____ Box number _____

General location _____
_____

Appearance of box from outside or ground _____
_____

Contents of box _____
_____
_____

Species using box _____

Is there an adult animal present ? _____

Are there eggs present ? _____ How many ? _____

Are there eggshell membranes present ? _____How many ? _____

Are there any unhatched eggs present ? _____ How many ? _____

Are there young present ? _____ How many ? _____

Are all the young alive ? _____ Any dead ? _____

Is the box in good condition ? _____

What repairs (if any) are needed ? _____
_____
_____

Additional comments _____
_____
_____
_____
_____

Table 15. Incidental wildlife observation form

DELAWARE DIVISION OF FISH AND WILDLIFE

INCIDENTAL WILDLIFE OBSERVATION FORM

	DATE	SPECIES	LOCATION	NUMBER
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				
11.				
12.				
13.				
14.				
15.				

16.

17.

18.

19.

20.

21.

22.

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